

C L A I M S

1. A fiber optics transmission line characterized in that

5 single or a plurality of a graded index fiber is inserted in the middle of a transmission line formed by a single mode fiber, the single mode fiber including a core having a predetermined refractive index and a cladding having a refractive index smaller than that of the core.

10 2. The fiber optics transmission line according to claim 1, characterized in that

the graded index fiber is fusion spliced to the single mode fiber in the middle of the fiber optics transmission line.

15 3. The fiber optics transmission line according to claim 1, characterized in that

the inserted graded index fiber is so designed that its mode field diameter gradually increases from a light entry side and decreases toward a light exit side.

20 4. The fiber optics transmission line according to claim 3, characterized in that

the length of the graded index fiber having a mode field diameter gradually increasing from a light entry side and decreasing toward a light exit side is $1/2$ of a pitch, where one pitch denotes a length of the transmission line
25 corresponding to one cycle during which the mode field diameter of a light periodically changes along the transmission line.

5. The fiber optics transmission line according to claim 4, characterized in that

the length of the graded index fiber having a mode field diameter gradually increasing from a light entry side and the length of the graded index fiber having a mode field diameter decreasing toward a light exit side, are both 1/4 of a pitch.

5 6. The fiber optics transmission line according to claim 3, characterized in that

 a single mode fiber having an expanded mode field diameter is inserted between the graded index fiber having a mode field diameter gradually increasing from a light entry
10 side and the graded index fiber having a mode field diameter decreasing toward a light exit side.

 7. The fiber optics transmission line according to claim 3, characterized in that

 a single mode fiber having a mode field diameter smaller
15 than the expanded mode field diameter of the graded index fiber is inserted between the graded index fiber having a mode field diameter gradually increasing from a light entry side and the graded index fiber having a mode field diameter decreasing toward a light exit side.

20 8. The fiber optics transmission line according to claim 3, characterized in that

 the expanded mode field diameter of the graded index fiber falls within a range from 15 to 85 μm .

 9. The fiber optics transmission line according to claim
25 8, characterized in that

 the expanded mode field diameter of the graded index fiber falls within a range from 15 to 65 μm .

 10. The fiber optics transmission line according to claim 3, characterized in that

the core diameter of the graded index fiber is 1.5 times or more the expanded mode field diameter of the graded index fiber, which is obtained at a location $1/4$ of a pitch from the light entry side thereof.

5 11. The fiber optics transmission line according to claim 10, characterized in that

the core diameter of the graded index fiber is 2 times or more the expanded mode field diameter of the graded index fiber, which is obtained at a location $1/4$ of a pitch from the
10 light entry side thereof.

12. The fiber optics transmission line according to claim 1, characterized in that

the graded index fiber is connected to the single mode fiber through a connector in the middle of the fiber optics
15 transmission line.

13. The fiber optics transmission line according to claim 12, characterized in that

the inserted graded index fiber is so designed that its mode field diameter gradually increases from a light entry
20 side and decreases toward a light exit side.

14. The fiber optics transmission line according to claim 13, characterized in that

the length of the graded index fiber having a mode field diameter gradually increasing from a light entry side and
25 decreasing toward a light exit side is $1/2$ of a pitch, where one pitch denotes a length of the transmission line corresponding to one cycle during which the mode field diameter of a light periodically changes along the transmission line.

15. The fiber optics transmission line according to claim 14, characterized in that

the length of the graded index fiber having a mode field diameter gradually increasing from a light entry side and the
5 length of the graded index fiber having a mode filed diameter decreasing toward a light exit side, are both $1/4$ of a pitch.

16. The fiber optics transmission line according to claim 13, characterized in that

a single mode fiber having an expanded mode field
10 diameter is inserted between the graded index fiber having a mode field diameter gradually increasing from a light entry side and the graded index fiber having a mode filed diameter decreasing toward a light exit side.

17. The fiber optics transmission line according to
15 claim 13, characterized in that

a single mode fiber having a mode field diameter smaller than the expanded mode field diameter of the graded index fiber is inserted between the graded index fiber having a mode field diameter gradually increasing from a light entry side
20 and the graded index fiber having a mode filed diameter decreasing toward a light exit side.

18. The fiber optics transmission line according to claim 13, characterized in that

the expanded mode field diameter of the graded index
25 fiber falls within a range from 15 to 85 μm .

19. The fiber optics transmission line according to claim 18, characterized in that

the expanded mode field diameter of the graded index fiber falls within a range from 15 to 65 μm .

20. The fiber optics transmission line according to claim 13, characterized in that

the core diameter of the graded index fiber is 1.5 times or more the expanded mode field diameter of the graded index fiber, which is obtained at a location $1/4$ of a pitch from the light entry side thereof.

21. The fiber optics transmission line according to claim 20, characterized in that

the core diameter of the graded index fiber is 2 times or more the expanded mode field diameter of the graded index fiber, which is obtained at a location $1/4$ of a pitch from the light entry side thereof.

22. The fiber optics transmission line according to claim 1, characterized in that

the graded index fiber is connected to the single mode fiber through a V-groove in the middle of the fiber optics transmission line.

23. The fiber optics transmission line according to claim 22, characterized in that

the inserted graded index fiber is so designed that its mode field diameter gradually increases from a light entry side and decreases toward a light exit side.

24. The fiber optics transmission line according to claim 23, characterized in that

the length of the graded index fiber having a mode field diameter gradually increasing from a light entry side and decreasing toward a light exit side is $1/2$ of a pitch, where one pitch denotes a length of the transmission line corresponding to one cycle during which the mode field

diameter of a light periodically changes along the transmission line.

25. The fiber optics transmission line according to claim 24, characterized in that

5 the length of the graded index fiber having a mode field diameter gradually increasing from a light entry side and the length of the graded index fiber having a mode field diameter decreasing toward a light exit side, are both $1/4$ of a pitch.

26. The fiber optics transmission line according to
10 claim 23, characterized in that

 a single mode fiber having an expanded mode field diameter is inserted between the graded index fiber having a mode field diameter gradually increasing from a light entry side and the graded index fiber having a mode field diameter
15 decreasing toward a light exit side.

27. The fiber optics transmission line according to claim 23, characterized in that

 a single mode fiber having a mode field diameter smaller than the expanded mode field diameter of the graded index
20 fiber is inserted between the graded index fiber having a mode field diameter gradually increasing from a light entry side and the graded index fiber having a mode field diameter decreasing toward a light exit side.

28. The fiber optics transmission line according to
25 claim 23, characterized in that

 the expanded mode field diameter of the graded index fiber falls within a range from 15 to 85 μm .

29. The fiber optics transmission line according to claim 28, characterized in that

the expanded mode field diameter of the graded index fiber falls within a range from 15 to 65 μm .

30. The fiber optics transmission line according to claim 23, characterized in that

5 the core diameter of the graded index fiber is 1.5 times or more the expanded mode field diameter of the graded index fiber, which is obtained at a location $1/4$ of a pitch from the light entry side thereof.

31. The fiber optics transmission line according to
10 claim 30, characterized in that

the core diameter of the graded index fiber is 2 times or more the expanded mode field diameter of the graded index fiber, which is obtained at a location $1/4$ of a pitch from the light entry side thereof.